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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : H03F 3/217

A1

(11) International Publication Number: WO 00/35082

(43) International Publication Date: 15 June 2000 (15.06.00)

(21) International Application Number: PCT/EP99/09205

(22) International Filing Date: 24 November 1999 (24.11.99)

(30) Priority Data:
98204174.1 8 December 1998 (08.12.98) EP

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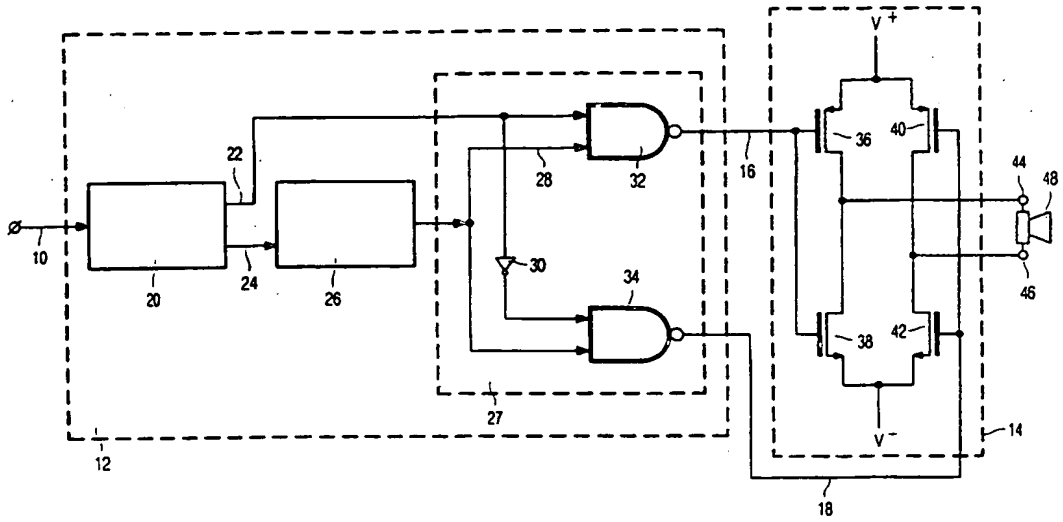
(81) Designated States: JP, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: DEVICE FOR AMPLIFYING SIGNALS



(57) Abstract

The device for amplifying input signals (10) comprises a control stage (12) and a switching bridge amplifier (14), which is coupled to said control stage via at least first and second control signals (16, 18). The bridge amplifier (14) can be switched in at least two states, in dependence upon the control signals (16, 18). The control stage (12) is embodied so as to control only a single substantially passive state of the bridge amplifier (14), as a result of which relatively small switching losses occur.

Device for amplifying signals

The invention relates to a device for amplifying input signals, comprising a control stage and a switching bridge amplifier, which is coupled to said control stage via at least first and second control signals, the bridge amplifier being switchable in at least two states in dependence upon the control signals.

The invention also relates to an audio system and a hearing aid provided with such a device.

Such a device is disclosed in US-A 5 387 875. In audio systems and hearing aids, such devices are often used to amplify audio signals. The device known from said United States patent document comprises an oscillator for generating a triangular reference signal, and first and second comparators for generating, respectively, a first and a second control signal. An input signal to be amplified is converted to the first control signal in the first comparator by comparing the input signal with the reference signal. Similarly, the input signal inverted by an inverter is converted to the second control signal in the second comparator by comparing the inverted input signal with the reference signal. Subsequently, the input signal is amplified by supplying the control signals to a switching bridge amplifier composed of four switches.

The switching bridge amplifier incorporated in the known device may be in four different states. These states are diagrammatically shown in Figs. 2A through 2D. The Figs. 2A and 2B show two active states of the bridge amplifier, wherein the bridge amplifier supplies power to a load 48. The Figs. 2C and 2D show two passive states of the bridge amplifier, wherein the bridge amplifier does not supply power to the load 48. In the known device, all four states of the switching bridge amplifier are controlled by the control stage.

In the known device, relatively much power is dissipated in the bridge amplifier.

It is an object of the invention to provide a device of the type mentioned in the opening paragraph, in which relatively little power is dissipated in the bridge amplifier.

To achieve this, the device in accordance with the invention is characterized in that the control stage is embodied so as to control only a single substantially passive state of the bridge amplifier. In the known device, both passive states of the switching bridge amplifier, as shown in Figs. 2C and 2D, are controlled by the control stage.

control signals 16 and 18. By controlling the bridge amplifier 14 by these control signals 16 and 18, an input signal amplified by the device is obtained between two outputs 44 and 46. The input signal 10 may be, for example, an audio signal which, after it has been amplified, can be converted into sound by a loudspeaker 48 arranged between the outputs 44 and 46.

The control stage 12 comprises a conversion unit 20, a pulse width modulator 26 and a generator 27. In the conversion unit 20, the input signal 10 is converted to a sign and magnitude-coded signal, whereafter the sign 22 and the magnitude 24 of the coded signal are separated from each other. The magnitude 24 of the coded signal is subsequently converted to a pulse width-modulated signal 28 in the pulse width modulator 26. In the generator 27, the control signals 16 and 18 are generated from the pulse width-modulated signal 28 and the sign 22 of the coded signals.

The generator 27 comprises first and second NAND gates 32 and 34, and an inverter 30. By presenting the pulse width-modulated signal 28 and the sign 22 of the coded signals at the inputs of the first NAND gate 32, the first control signal 16 is formed at an output of the first NAND gate 32. The second control signal 18 is formed at an output of the second NAND gate 32 by presenting, at the inputs of the second NAND gate 34, the pulse width-modulated signal 28 and the sign 22 of the coded signals, which is inverted by the inverter 30.

The switching bridge amplifier 14 comprises four field effect transistors 36, 38, 40 and 42. Here, these transistors function as switching elements. The transistors 36 and 40 are so-called n-channel field effect transistors, and the transistors 38 and 42 are so-called p-channel field effect transistors. The sources of the transistors 36 and 40 are connected to a relatively high supply voltage V^+. The sources of the transistors 38 and 42 are connected to a relatively low supply voltage V^-. The drains of the transistors 36 and 38 are connected to each other and to the output 44. The drains of the transistors 40 and 42 are connected to each other and to the output 46. The gates of the transistors 36 and 38 are connected to the first control signal 16. The gates of the transistors 40 and 42 are connected to the second control signal 18.

If the first control signal 16 has a logic 1 value, then the transistor 36 is turned on, i.e., there is no conduction between the drain and the source of this transistor, while the transistor 38 is turned off, i.e., the drain and the source of this transistor are conductively interconnected. If the second control signal 18 has a logic 1 value, then the transistor 40 is turned on, i.e. there is no conduction between the drain and the source of this transistor, while the transistor 42 is turned off, i.e., the drain and the source of this transistor are conductively interconnected. At these values of the control signals 16 and 18, the bridge amplifier 14 is in

V^+, so that, also in this state, no current flows through the load 48. In the device in accordance with the invention, the switching bridge amplifier 14 is controlled in such a manner that only one of the passive states shown in Figs. 2C and 2D occurs.

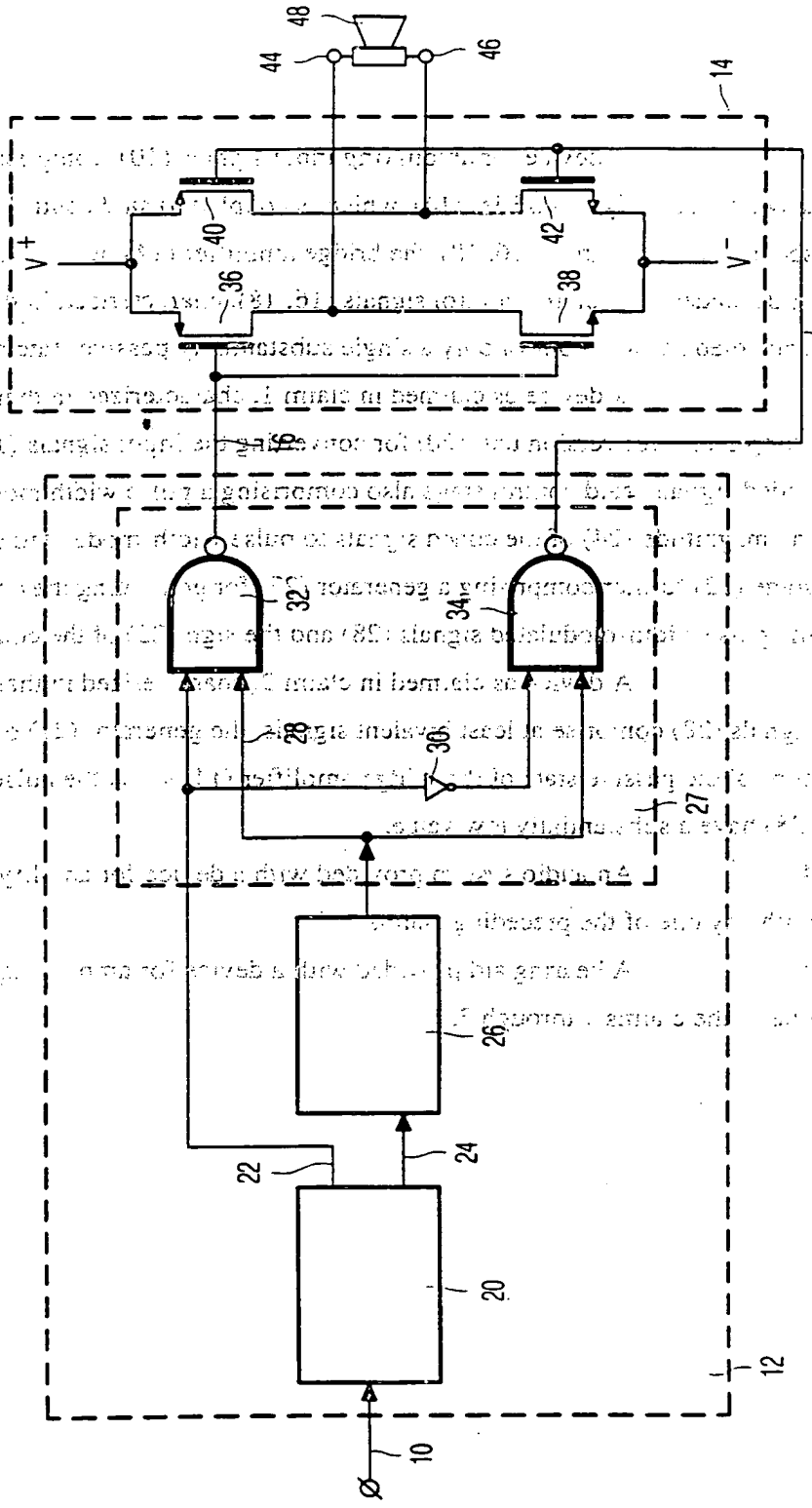


FIG. 1

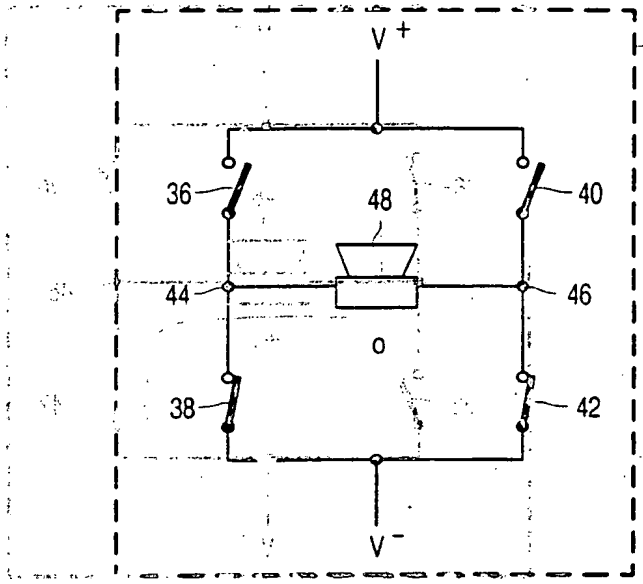


FIG. 2C

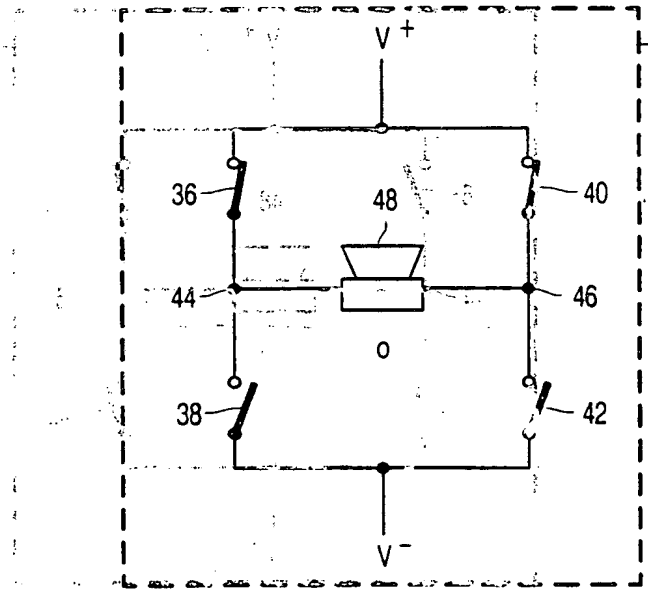


FIG. 2D

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internal Application No
PCT/EP 99/09205

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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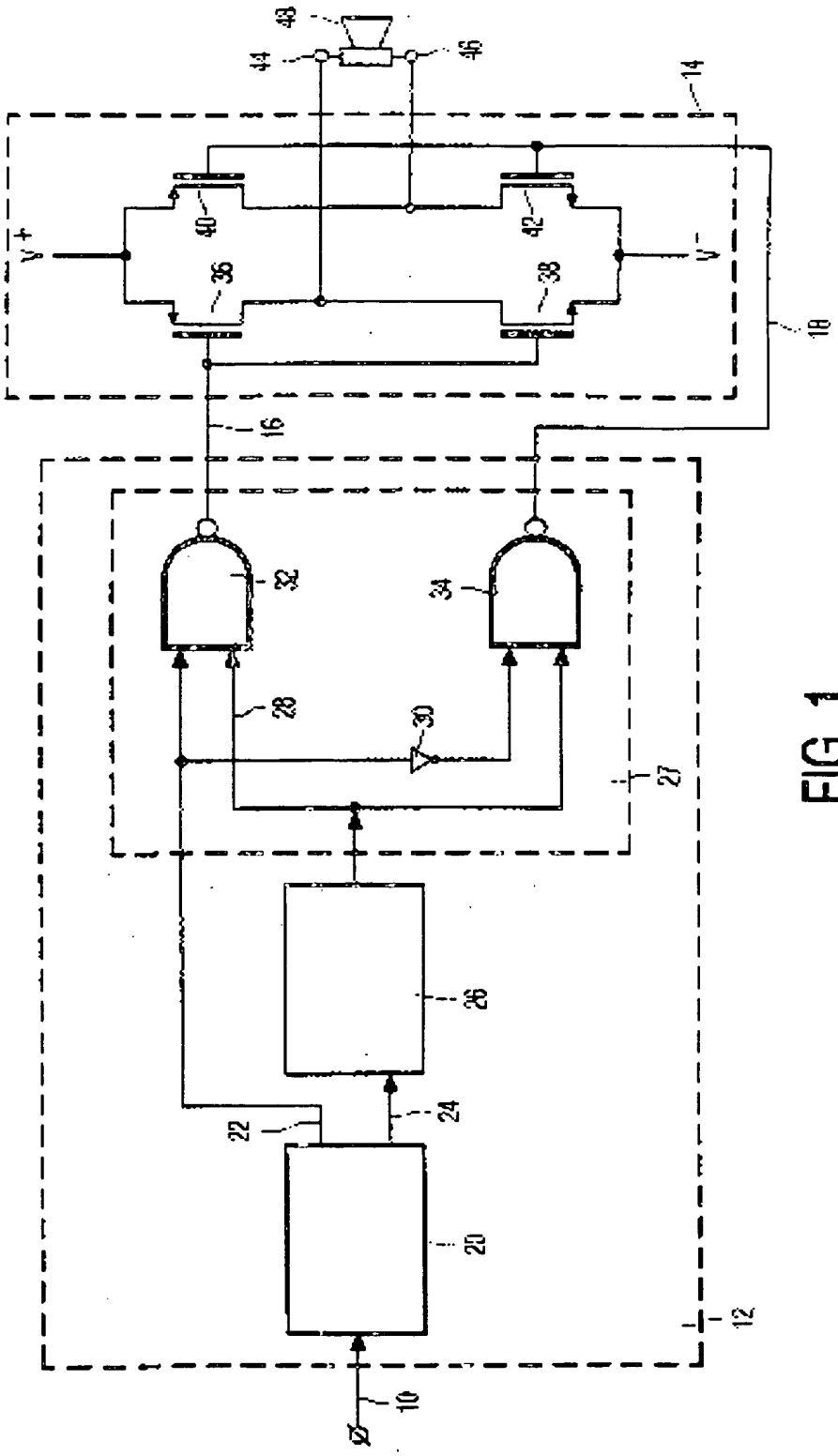

FIG. 1

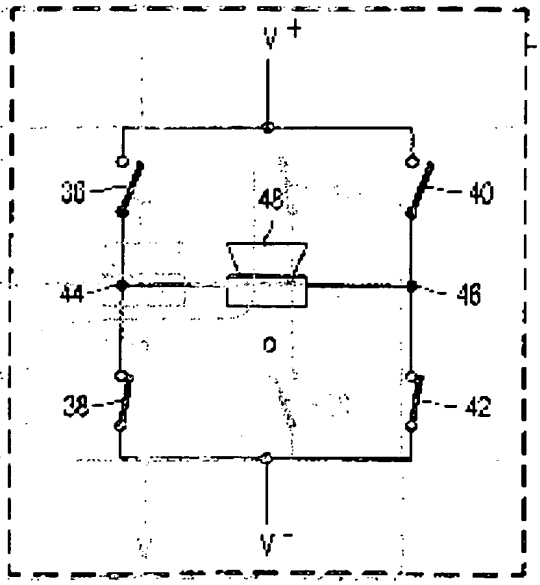

FIG. 2C

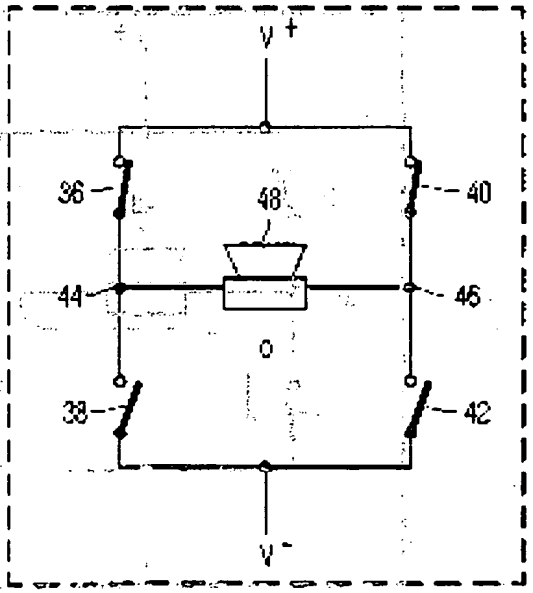

FIG. 2D